GTE-ERS
TECHNICAL LIBRARY
02436

GENERAL RESISTANCE

THERMOCOUPLE SIMULATOR
MODELS ETS-15, TSC-46, TSC-47UR
INSTRUCTION MANUAL
(Patent No. 3504522)

MP MASTER
MA32616

THERMOCOUPLE SIMULATOR
MODELS ETS-15, TSC-46, TSC-47UR
INSTRUCTION MANUAL
(Patent No. 3504522)

NOTE: Throughout this manual, wherever the Model TSC-46 is referred to, please bear in mind that the Model TSC-47UR has the same operating characteristics and features, but has one additional decade of resolution, and other improved specifications (see specification sheet herein).

PRIME TECHNOLOGY, INC.
General Resistance Division
P.O. Box 185 / Twin Lakes Road
North Branford, CT 06471

Ph: (203) 481-5721
FAX: (203) 481-8937

COPYRIGHT 1990

Digitized by the Internet Archive
in 2025

https://archive.org/details/manualsplus_05576

TABLE OF CONTENTS

SECTION	PAGE	TITLE
	2, 3	Table of Contents
	4	List of Illustrations
	5	Limited Warranty
1.0	7	Introduction & Description
1.1	7, 8	General
1.2	11, 12	Specification Sheet
2.0	13	Initial Set-Up
2.1	13	Unpacking & Inspection
2.2	13	Output Cables
2.3	14	Output Connector
3.0	17	Operating Instructions (TSC Series)
3.1	17	Operating Controls
3.2	18, 19	Operation as a Thermocouple Simulator
3.3	19	Operation as a Voltage/ Current Reference Source
4.0	20	Operating Instructions (ETS-15)
4.1	20	Operating Controls
4.2	22	Operation: Zero Ohms Thermocouple Simulation Mode

TABLE OF CONTENTS (continued)

SECTION	PAGE	TITLE
4.3	23	Operation: Run-Up Ohms Thermocouple Simulation Mode
4.4	23	Operation: Measure Mode
4.5	23	Operation: Control Mode
4.6	24	Battery Operation
5.0	25	Repair and Maintenance
5.1	25	Repair
5.2	25	Maintenance
5.2.1	25	Amplifier Zero Set (TSC Series)
5.2.2	26	Amplifier Zero Set (ETS-15)
5.2.3	26	Reference Source Calibration (TSC Series)
5.2.3	27	Reference Source Calibration (ETS-15)
5.3	28	Optional Accessories
6.0	29, 30	TSC used as a Voltage/Current Source

LIST OF ILLUSTRATIONS

FIGURE	PAGE	TITLE
A	6	Photographs (ETS & TSC)
B	9	Systems Block Diagram
C	10	Output Cable & Connector
D	15	Front Panel Controls (TSC-46)
E	16	Front Panel Controls (TSC-47UR)
F	21	Front Panel Controls (ETS-15)

LIMITED WARRANTY

General Resistance Div. warrants each instrument to be free from defects in material and workmanship for a period of one year from date of purchase.

The obligation of General Resistance Div. under this Warranty is limited solely to servicing or adjusting any failed instrument returned, shipped prepaid, to the factory for that purpose.

Units returned under this Warranty shall be examined by General Resistance Div. to establish that the failure resulted from defective material and/or workmanship and not as a result of misuse, neglect or improper operation, which latter failure is not within the meaning of this Warranty.

This Warranty does not cover collateral or consequential damages of any nature, type or description, whether resulting from express warranties, implied warranties or negligence.

General Resistance Div. reserves the right to make changes to design at any time without incurring any obligation to install same in units previously purchased.

This Warranty is expressly in lieu of all other obligations or liabilities on the part of General Resistance Div., express or implied, and General Resistance Div. neither assumes nor authorizes any person to assume for them any other liability in connection with the sale of General Resistance Div. products.

PHOTOGRAPHS (ETS & TSC)

FIGURE A

1.0 INTRODUCTION AND DESCRIPTION

1.1 GENERAL

General Resistance Thermocouple Simulators (ETS/TSC) are versatile laboratory instruments that provide high precision and stability in compact portable units.

They are designed and constructed as to be essentially independent of the ambient temperature and loading within their ratings.

Each has the following basic functional modules:

1. A chopper-stability operational amplifier.
2. A highly stable reference source.
3. A Kelvin-Varley potential divider.
4. A cold junction compensator (CJC) for each of 5 separate thermocouple systems.
5. Connection facilities for any thermocouple type.

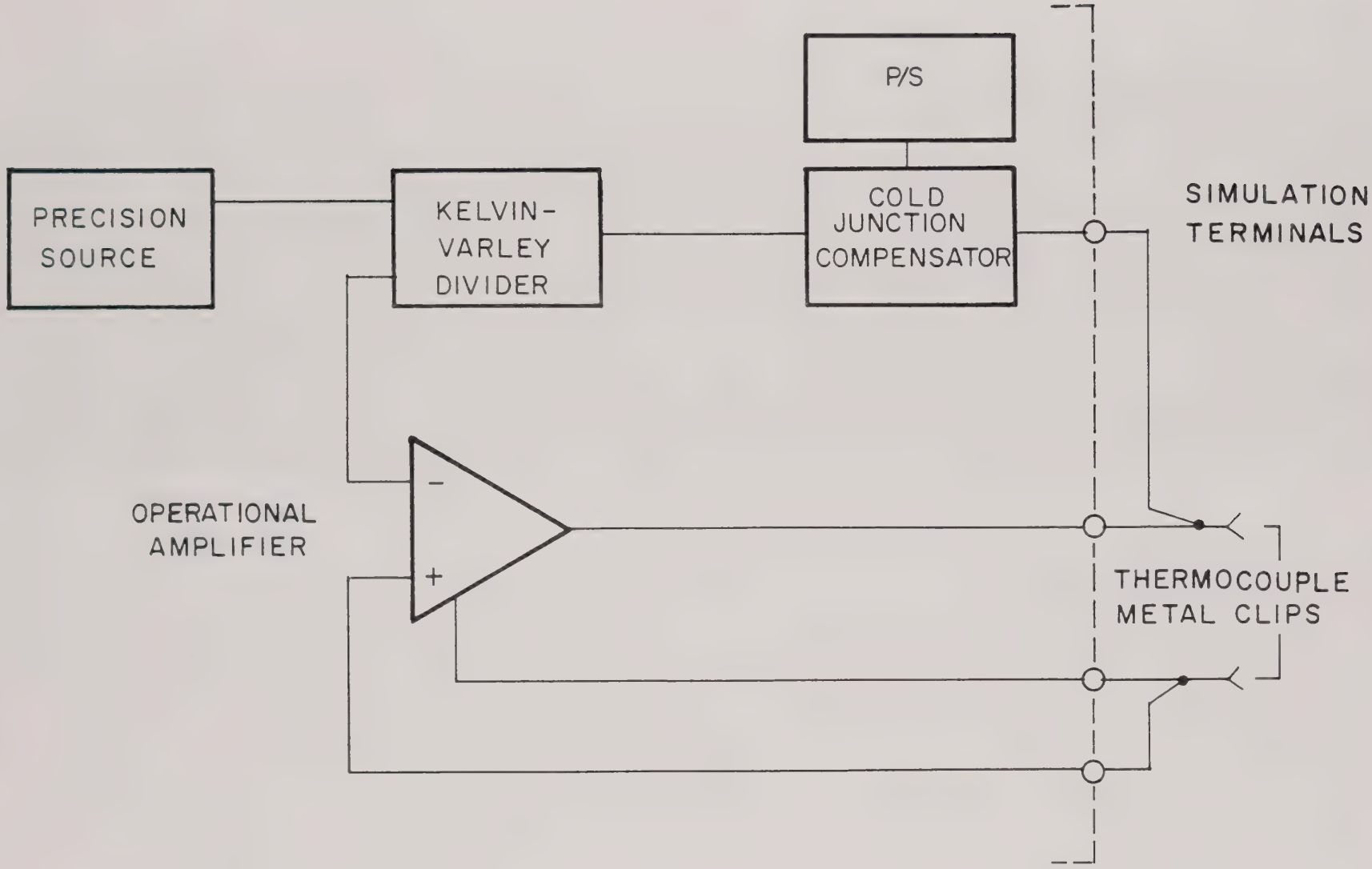
TSC Series instruments are 6-7/16" high by 6" wide by 7" deep and weigh 9 pounds.

The ETS-15 is 7" high by 8" wide by 10-5/16" deep; it weighs 11 pounds.

The instruments are shown in Figure A and a functional block diagram is shown as Figure B.

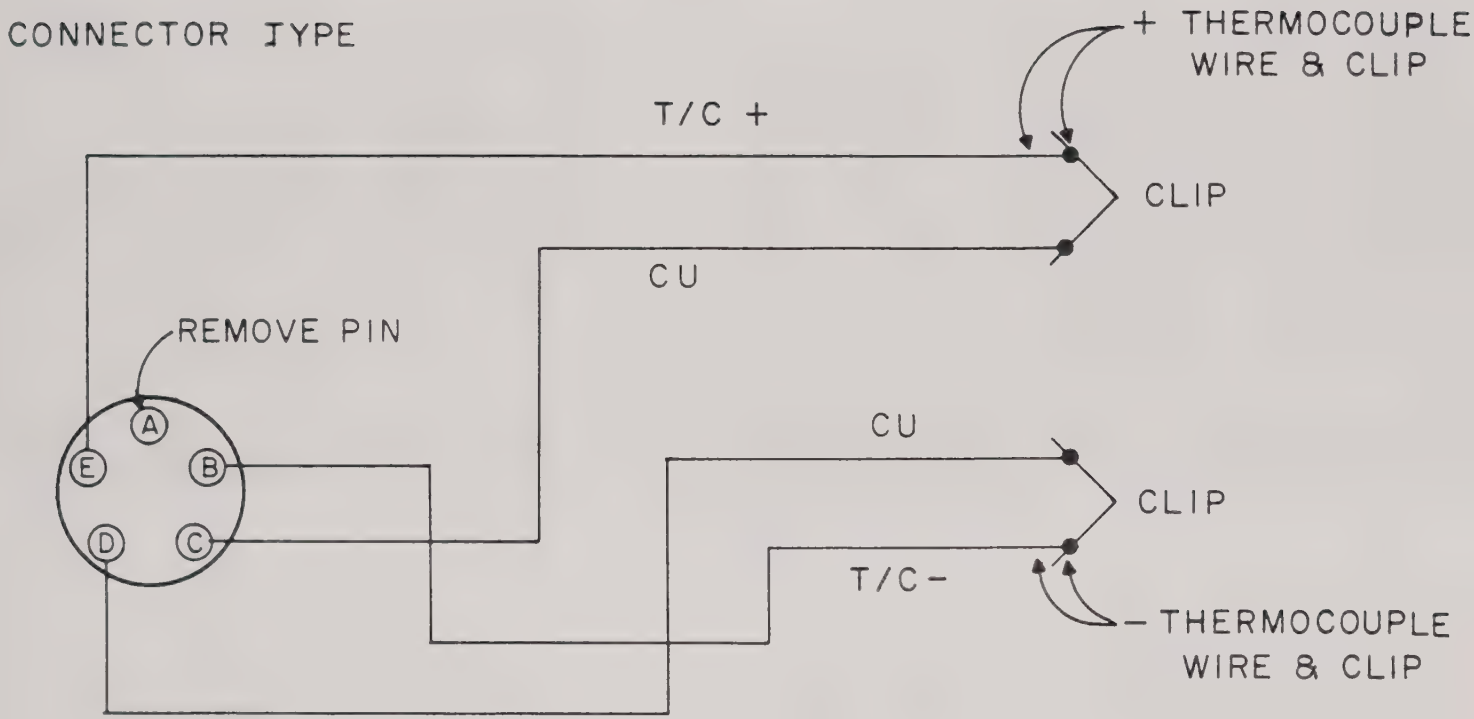
A stable reference voltage source is precisely controlled by a Kelvin-Varley divider (KVD) in the feedback loop of a high gain chopper-stablized amplifier. The feedback loop also contains the cold junction compensator whose values reflect the choice of the thermocouple system. The unique output coupling arrangement permits proper connection to any thermocouple system.

At the output terminals, the arrangement is equivalent to a thermocouple located in a temperature environment that would give the same voltage. The use of remote sensing leads extends the thermocouple terminals to the connection clips



THERMOCOUPLE SIMULATOR
SYSTEM BLOCK DIAGRAM

FIGURE B



OUTPUT CABLE & CONNECTOR
FIGURE C

GENERAL RESISTANCE INSTRUMENTS

ELECTRONIC THERMOCOUPLE SIMULATORS

ETS / TSC SERIES

CALIBRATE/TROUBLESHOOT/ANALYZE

These versatile patented* instruments are not dedicated to a particular temperature range or thermocouple type, so they permit simulation of the five most widely used thermocouples internally reference junction compensated to 0°C. (Other materials and reference temperatures optional.)

Since the output is dialed in voltage, rather than temperature, the ETS/TSC can cope with any reference table, any thermocouple materials, and any temperature. The accuracy of the simulated temperature is ±¼°C.(1)

Because these instruments have "zero" output impedance (the ETS also has built-in run-up capability), the system element (readout, scanner, temperature controller, etc.) undergoing test/analysis/calibration responds only to the simulated temperature signal provided by the ETS or TSC, so there is no need to disturb circuit connections. The environment of the system's thermocouple has no effect on the system while the ETS/TSC is connected (ETS in Zero Ohms Thermocouple Simulation mode).

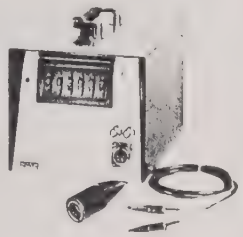
A single pair of any of the following Thermoclips ™ is supplied with each instrument (please specify your choice). Additional pairs, or other materials, are optional.

TYPE	THERMOCOUPLE MATERIALS
E	Chromel/Constantan
J	Iron/Constantan
K	Chromel/Alumel
T	Copper/Constantan
S	Platinum/Platinum 10% Rhodium (simulated)

U.S. Patent No. 3,504,522

ETS Series

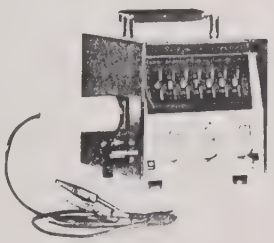
- *TRULY PORTABLE. BATTERY OR LINE OPERATED*
- *BUILT IN NULL DETECTOR FOR TEMPERATURE MEASUREMENTS*
- *"RUN UP" POT FOR EASY CALIBRATION OF LOOP IMPEDANCE DEPENDENT ANALOG READOUTS*
- *"CONTROL" MODE PROVIDES ERROR SIGNAL FOR CORRECTION OF SYSTEM TEMPERATURE*
- *5 DIGITS; RESOLUTION OF 00.001 mV (1μV)*
- *WIDE RANGE WILL SIMULATE THE OUTPUT OF ANY THERMOCOUPLE AT ANY TEMPERATURE*
- *ACCURACY OF SIMULATION: ±¼°C*
- *OPTIONAL COPPER OUTPUT*



TSC Series

- *RESOLUTIONS TO 0.1 μV*
- *RANGES: 0 to ±1Vdc, 0 to ±10Vdc*
- *MAXIMUM LOAD CURRENT: 30 mA*
- *ACCURACIES TO ±0.0015% OF SETTING*
- *THE TSC IS A DIAL-A-SOURCE WITH ITS USUAL VOLTAGE/CURRENT OUTPUTS; FOLLOWING THE DAS CIRCUITRY ARE BUILT-IN SOLID STATE COLD JUNCTION COMPENSATORS FOR THE SIMULATION OF THERMOCOUPLES. THUS, TSC's PROVIDE ALL THE PERFORMANCE FEATURES OF THE EQUIVALENT DAS's* IN ADDITION TO SIMULATING THERMOCOUPLES.*

*TSC-46 DAS-46AX; TSC 47UR DAS-47AL



PLEASE SEE REVERSE SIDE FOR OTHER UNIQUE FEATURES

SPECIFICATIONS:

	Model ETS-15	Model TSC-46	Model TSC-47UR
Resolution	00.001 mV (1μV)	1μV or 10μV(2)	0.1μV or 1μV(2)
Range(s), full scale, dc	±100mV	±1V & ±10V	
Number of decades	5	6	7
Accuracy of voltage setting @ +25°C	±10μV	±0.0025%(3)	±0.0015%(3)
Accuracy of thermocouple simulation	±¼°C(1)		
Output voltage temperature coefficient	±1 ppm/°C typ. ±2 ppm/°C max.		±0.7 ppm/°C typ. ±1.5 ppm/°C max.
Output voltage stability @ +25°C	± 7 ppm/24 hrs. ±20 ppm/year		± 5 ppm/24 hrs. ±15 ppm/year
Maximum load current	30mA		
Line regulation (105-125 Vac)	±0.5 ppm		
Load regulation (no load to full load)	1 ppm ±1μV peak		
Isolation	Floating output; either terminal may be grounded, or guarded up to 500V with respect to ground. Leakage is approx. $10^9\Omega$ and less than 20pF		
Typical output impedance	50μΩ		
Noise & ripple(4)	20μV peak	3 ppm or 20μV peak(5)	2 ppm or 15μV peak(5)
Input power	115V, 60 Hz(6)		
Dimensions	7"h. x 8"w. x 10-5/16" d. (178 x 203 x 262mm)	6-7/16"h. x 6"w. x 7"d. (164 x 152 x 178mm)	

(1) Providing that output of thermocouple simulated is ≧ 40μV/°C. Accuracy of simulation of noble metals with outputs ≧ 10μV/°C is ±1°C.
(2) Dependent on range. (4) Exclusive of random transients. Dc to 10kHz (6) Specify if 220V, 50 Hz operation is desired.
(3) ±5μV. (5) Whichever is greater.

All specifications subject to change without notice

GENERAL RESISTANCE, INC.
Twin Lakes Road
North Branford CT 06471
[203] 481 5721 • TWX 710 456 3092

© 1982 General Resistance, Inc.

A PRIME TECHNOLOGY COMPANY

Printed in U.S.A

GENERAL RESISTANCE INSTRUMENTS

ETS/TSC SERIES
ELECTRONIC THERMOCOUPLE SIMULATORS

ETS-15 OPERATING FEATURES:

The ETS provides voltages equivalent to the output of any thermocouple at any temperature.

- **ZERO OHMS THERMOCOUPLE SIMULATION:** Select the appropriate Thermochips™ and clip into the system. There is no need to disrupt system wiring, since the output impedance of the ETS is "zero." Any temperature equivalent voltage is dialed, and this known signal is then used to calibrate or trouble shoot scanners, linearizers, and/or readout devices.
- **RUN-UP OHMS THERMOCOUPLE SIMULATION:** The built-in run-up pot is set to the system impedance and the ETS output (via Thermochips) is substituted for the active thermocouple and associated wiring in order to calibrate loop impedance-dependent analog readout devices.
- **MEASURE:** Temperature can be measured by connecting the measuring active thermocouple to the ETS by means of the appropriate Thermochips and adjusting the thumbwheel switches until a null is indicated on the built in meter, which has a logarithmic response.
- **CONTROL:** With the proper Thermochips connected, any voltage difference between that set on the ETS dials and that produced by the system thermocouple is amplified by a fixed gain of 25. This error signal appears at the "control" terminals, and can provide external control circuitry with temperature correction information, activate alarms, etc.
- **BATTERY OPERATION:** The ETS will operate for 8 hours on a full charge and will recharge within 16 hours. This instrument trickle charges as long as it is plugged in, whether turned "on" or "off," and is operative during the charge cycle. Battery condition is indicated in two ways: when the pilot lamp starts flashing, the battery needs recharging; or, by turning to "battery check," its condition is shown in a special area on the null meter.

TSC-46/TSC-47UR OPERATING FEATURES:

The TSC Series is designed to perform as both a thermocouple simulator and as a high accuracy voltage/current source with a wide range of applications across the electronics field.

- **THERMOCOUPLE SIMULATION:** Operates the same as the ETS-15 does in Zero Ohms mode. See above.
- **MEASURE:** Same as ETS 15 above (external null detector required)
- **CONSTANT VOLTAGE SOURCE:** Provides full scale outputs of ±1Vdc & ±10Vdc at 30mA maximum load current. TSC-46 resolution: 1μV on 1V range, 10μV on 10V range; accuracy: ±0.0025% of setting; stability: ±7ppm/24 hours, ±20 ppm/year. TSC 47UR resolution: 0.1μV on 1V range, 1μV on 10V range; accuracy: ±0.0015% of setting; stability: ±5 ppm/24 hours, ±15 ppm/year. Other outstanding features include "zero" output impedance, and remote sensing. An optional LNA-100 Low Noise Attenuator reduces dialed output voltage, and any drift or offset, by a factor of 100, thus decreasing "noise" to the nanovolt level, permitting use of the TSC at extremely low output voltage levels where output current is not a consideration. The accuracy of the LNA-100 is ±0.005%.
- **CONSTANT CURRENT SOURCE:** With the addition of an optional DAA-10 adaptor, the TSC Series performs as a constant current source. The full scale current output of either the TSC 46 or the TSC 47UR is ±10 mA on the 1V range, ±30 mA on the 10V range. Resolution of the TSC 46: 10nA on the 1V range, 100nA on the 10V range; accuracy ±0.0055% of setting. Resolution of the TSC 47UR: 1nA on the 1V range, 10nA on the 10V range; accuracy: ±0.0045% of setting.
- **APPLICATIONS:** In addition to simulating thermocouples, TSC Series instruments function as transportable standards, as much at home on site during oil well exploration as they are in the metrology lab. Applications include use in linearity testing of amplifiers and A/D converters, transducer simulation, test equipment calibration, and stability testing. The highly adaptable TSC Series provides "standards lab" accuracy in the field and on the production floor, as well as in the lab.

RELATED PRODUCTS:

The General Resistance product line includes a number of other devices of particular interest to the user of thermocouples and related systems. These products include ice-point references, electronic reference junction simulators, RTD simulators, and loop calibration instrumentation. Please request additional information.

GENERAL RESISTANCE, INC.
Twin Lakes Road
North Branford CT 06471
(203) 481 5721 • TWX 710 456 3092

A PRIME TECHNOLOGY COMPANY

2.0 INITIAL SET-UP

2.1 UNPACKING AND INSPECTION

On receipt of unit

1) Check all switches for proper operation, ie: thumbwheels have a good detent action and no broken tabs. Rotary switch positions should match the panel markings.

2) Check that the correct thermocouple cable(s) are with the instrument.

3) Check operation (see Section 3.0 for TSC; 4.0 for ETS).

2.2 OUTPUT CABLES

The output and connector are essential parts of the instrument. One connector cable assembly is supplied with each instrument. Factory assembled cables are available for all thermocouple types.

The output permits the instrument to be connected properly to the corresponding thermocouple system without extraneous thermal emfs.

The cable consists of four wires (two of thermocouple materials, each with an associated sense line), two clips and 5-pin connector. Each clip is made with one jaw of copper and the other of thermocouple metal, which are connected to the like material of the cable. The outputs of thermocouple simulators are injected into the system under test/calibration.

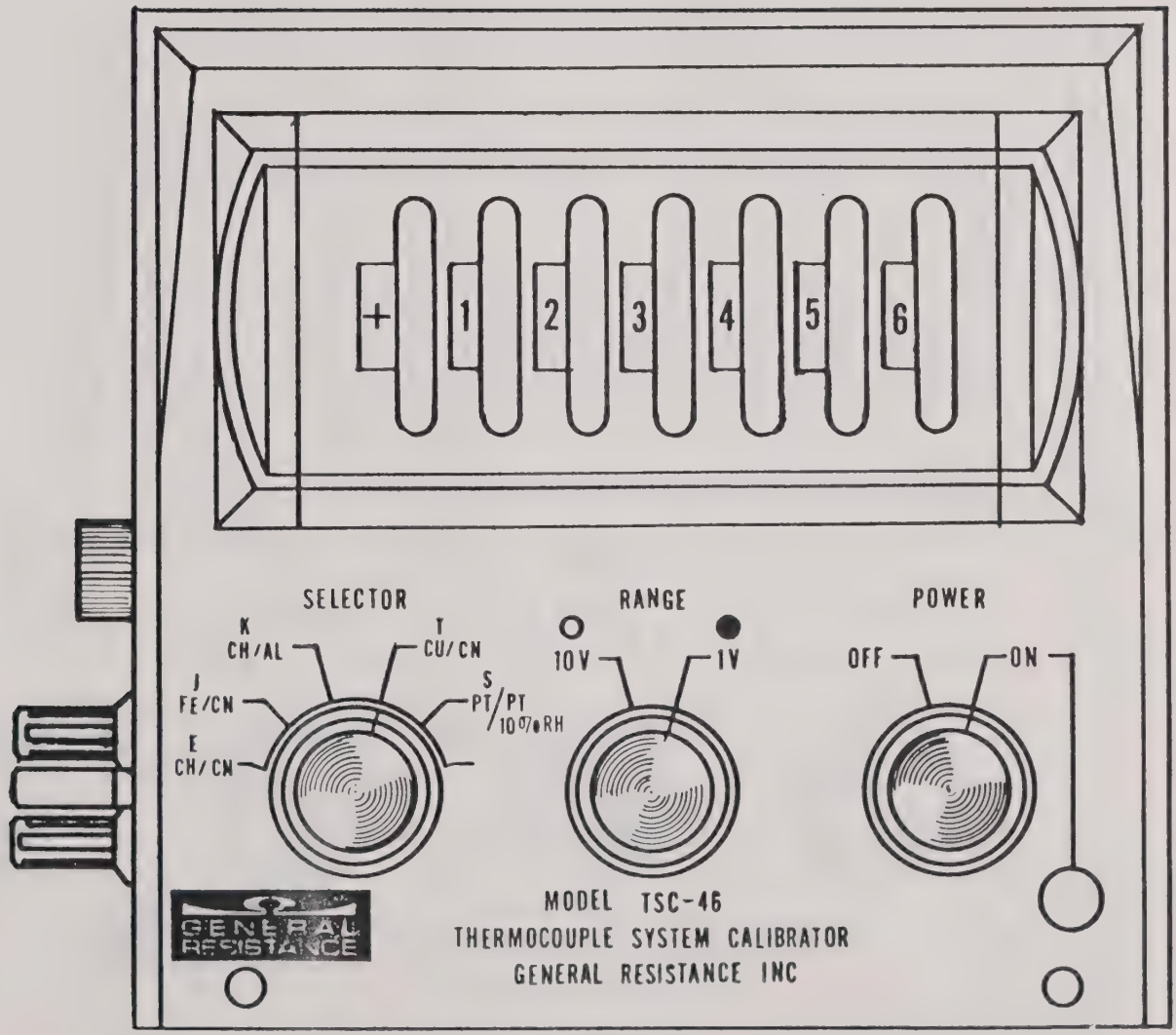
2 3 OUTPUT CONNECTOR

The thermocouple simulator must be connected without spurious or temperature dependent emfs, therefore, cold junction compensation (0 deg C reference) is used to cancel temperature effects.

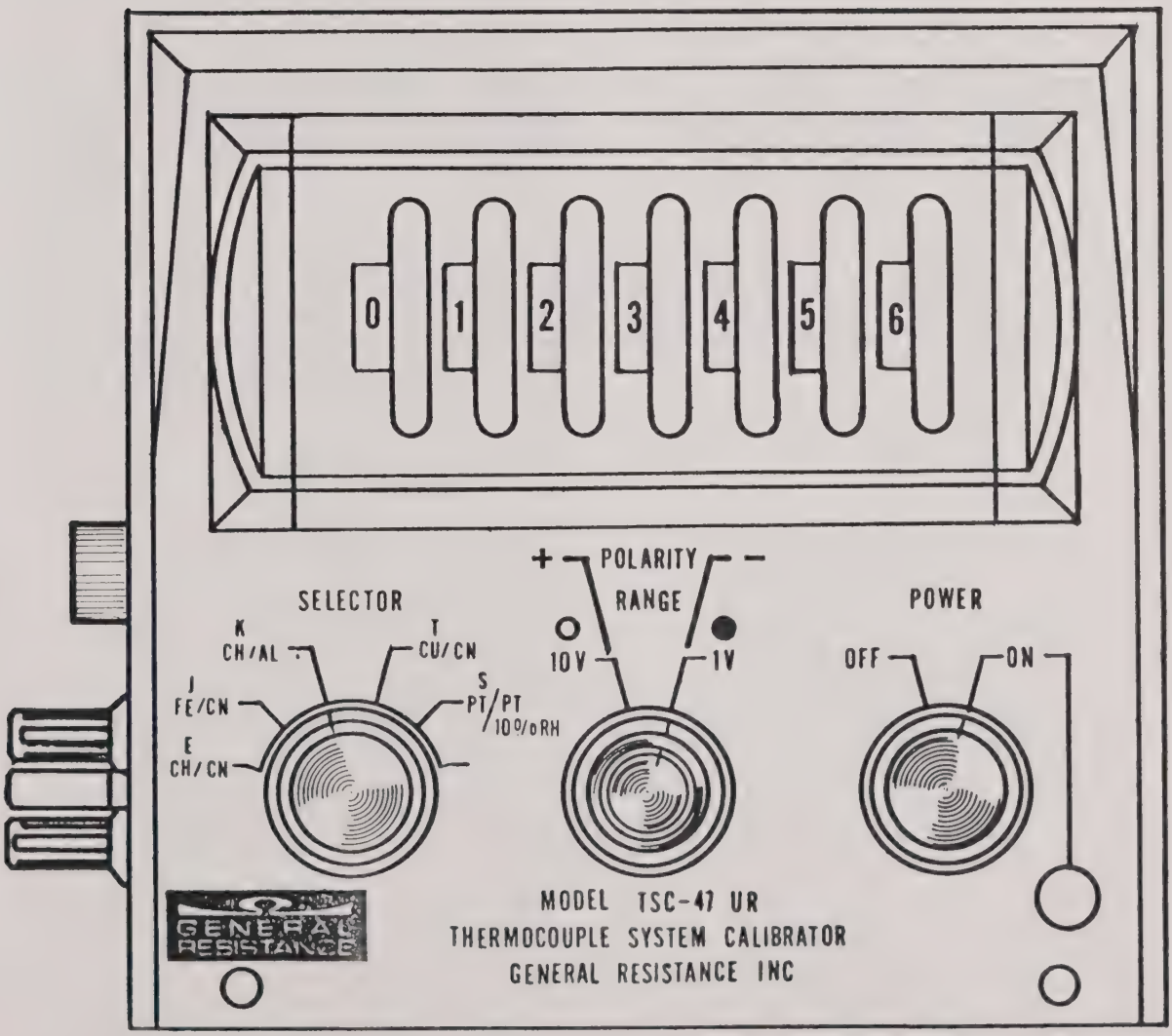
Since copper to thermocouple metal junctions are made at the connector, the temperature sensitive resistor of the reference junction compensator is implanted in the output receptacle. The resistor and the junctions are at the same temperature and isolated from local temperature variations by the connector and its covering.

The schematic diagram of the output cable and connector is shown in Figure C. The receptacle pins are gold plated to minimize the thermal emf to copper. By changing the output connector and cable assembly, all thermocouple types can be accommodated.

FRONT PANEL CONTROLS
MODEL TSC-46
FIGURE D



FRONT PANEL CONTROLS
MODEL TSC-47UR
FIGURE E



3.0 OPERATING INSTRUCTIONS (TSC SERIES)

3.1 OPERATING CONTROLS

Front panel controls are shown in Figures D & E.

These consist of a power on/off switch, a pilot lamp, a range switch (1V/10V), a thermocouple material selector switch, a polarity selector and thumbwheel output voltage selector switches.

The most significant decade has stops below zero and above nine; intermediate decades have no stops and may be set to any value zero through nine; the least significant decade has no stops and may be set to any value zero through ten.

3.2 OPERATION AS A THERMOCOUPLE SIMULATOR

The sequence of operation is as follows:

1. With power switch OFF, set range switch to 1V position. Make sure terminal shorting plugs/links are connected.

2. Set selector switch to the thermocouple material in use.

3. Set all thumbwheel switches to 0.

4. Turn power switch to ON position; make sure that the pilot lamp is on and allow the unit to warm up for at least 90 seconds.

5. Insert the appropriate thermocouple cable into the connector.

6. Connect thermocouple clips to system to be calibrated/ tested.

7. Remove terminal shorting plugs/links.

   NOTE: WHEN CONNECTING OR REMOVING THERMOCLIPS FROM THE UNIT UNDER TEST/CALIBRATION, THE PLUS (+) SENSE AND THE MINUS (-) OUTPUT TO MINUS (-) SENSE. IF THEY ARE NOT, THE INSTRUMENT WILL SATURATE AT APPROXIMATELY 13V TRYING TO MAINTAIN THE REQUIRED VOLTAGE AT THE THERMOCLIPS. WHILE THIS IS NOT INJURIOUS TO THE TSC, IT MAY BE TO YOUR SYSTEM.

8. Dial the emf equivalent of the thermocouple at the desired temperature, observing the correct polarity. EXAMPLE: A typical application would be to check the calibration of the indicator portion of a Chromel-Alumel thermocouple system. In preparation, select the temperature calibration points and obtain the equivalent voltage for each of them from the appropriate thermocouple reference table(s).

3.2 (Continued)

EXAMPLE (Chromel/Alumel):

TEMPERATURE (^{O}C)	OUTPUT (mV)
300	+12.207
500	+20.640
800	+33.277
1100	+45.108

Attach the Chromel/Alumel cable to the output connector and the clips to the corresponding leads of the indicator. By successively setting the thumbwheels to:

+012207

+020640

+033277

+045108

your System indicator should successively display temperatures of 300, 500, 800 and 1100^{O}C respectively.

3.3 OPERATION AS A VOLTAGE/CURRENT REFERENCE SOURCE

See Section 6 of manual.

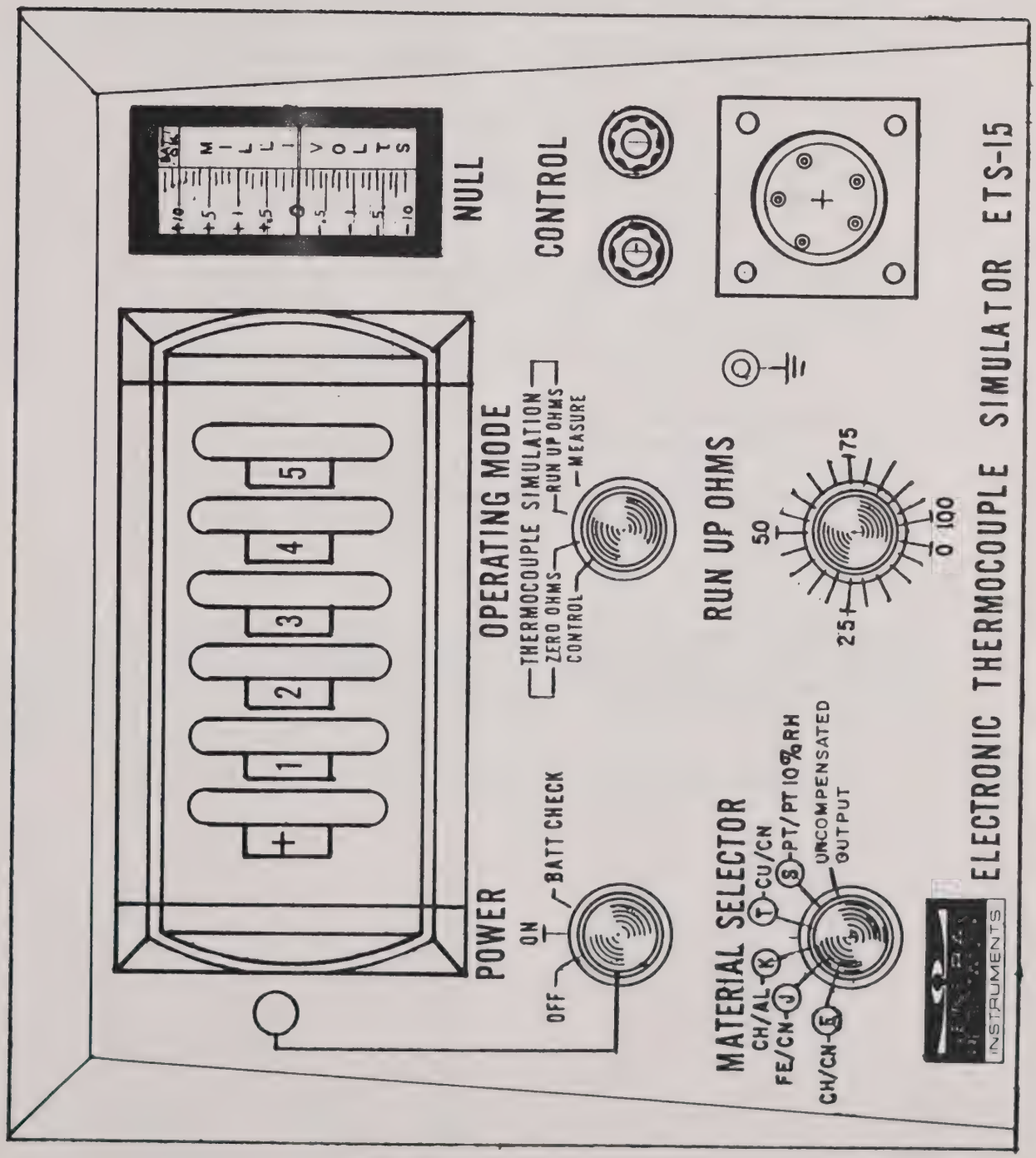
Also see Section 5.3: Optional accessories.

4.0 OPERATING INSTRUCTIONS (ETS-15)

4.1 OPERATING CONTROLS

Front panel controls are shown in Figure F. These consist of a power ON/OFF switch with a battery check position, a pilot lamp, a thermocouple material selector, an operating mode selector, a "run-up" pot, a null indicator and thumbwheel polarity & output voltage selector switches. The most significant decade has stops below zero and above nine; intermediate decades have no stops and may be set to any value zero through nine; the least significant decade has no stops and may be set to any value zero through ten.

FRONT PANEL CONTROLS
MODEL ETS-15
FIGURE F



4.2 OPERATION: ZERO OHMS THERMOCOUPLE SIMULATION MODE

A. The sequence of operation is as follows:

1. With power switch OFF, set Operating Mode to Zero ohms. (No shorting plugs/links are necessary since an automatic voltage limiting circuit prevents the ETS from going into saturation).

2. Set Material Selector to the thermocouple type in use.

3. Set all thumbwheel switches to 0.

4. Turn power to ON; make sure that the pilot lamp is on and allow the unit to warm up for at least 90 seconds.

5. Insert the appropriate thermocouple cable into the connector.

6. Connect thermocouple clips to system to be calibrated/tested.

7. Set the thumbwheel switches to the emf equivalent of the thermocouple at the desired temperature. Also, see Example in Step 8 of Section 3.2, bearing in mind that the ETS is a 5-decade single range instrument reading out in millivolts to 3 decimal places (LSD equals 1uV).

B. By switching Material Selector to Uncompensated Output and using the optional Uncompensated Output Adaptor (Type C-15), the ETS can be used as a remote sensing precision voltage source with a maximum output of +/-100 mV, 1uV resolution and a maximum load current of 30 mA.

Also, see Section 5.3 for other optional accessories.

4.3 OPERATION: RUN-UP OHMS THERMOCOUPLE SIMULATION MODE

Used to calibrate loop-impedence-dependent analog readout devices. The active thermocouple and its associated wiring must be disconnected from the readout. Set operating mode to Run-Up ohms, set run-up pot to the required system impedance (0 to 100 ohms). This impedance should equal that of the active thermocouple with its associated wiring and is specified on the readout device. Connect appropriate thermoclips to the readout. Balance of procedure is substantially as outlined in Section 4.2A.

4.4 OPERATION; MEASURE MODE

With the operating mode set to Measure, the temperature of the active thermocouple can be determined by connecting the appropriate thermoclips to it and adjusting the thumbwheel switches until a null is indicated on the built-in meter, which has a logarithmic response.

Follow the general procedure outlined in Section 4.2A.

4.5 OPERATION: CONTROL MODE

In the Control mode, with the proper thermoclips connected, any voltage difference between that set on the thumbwheel switches and that produced by the system thermocouple is amplified by a fixed gain of 25. This error signal appears at the Control terminals and can provide external control circuitry with analog information for temperature correction, activation of alarms, etc.

Follow the general procedure outlined in Section 4.2A.

4.6 BATTERY OPERATION

The ETS will operate for 8 hours on a full charge and will re-charge within 16 hours. This instrument trickle-charges as long as it is plugged in and can be operated during the charge cycle.

Battery condition is indicated in two ways: (1) By turning to "Battery check", battery condition is shown in a special area on the null meter scale; and (2) Whenever its condition weakens to the point where accurate operation may be affected, the pilot lamp flashes continually.

5.0 REPAIR AND MAINTENANCE

5.1 REPAIR

Repair of thermocouple simulators is limited to the replacement of pilot lamps or the line fuse.

The precise output values are dependent upon resistors matched and accurate to better than 0.001%. Should any of these resistors be damaged or over-dissipated, the instrument must be returned to the factory.

5.2 MAINTENANCE

The usual routine maintenance will be the periodic zero setting of the operational amplifier (all models) and recalibration of the reference source (TSC Series only). General Resistance Division offers complete calibration at a nominal charge.

5.2.1 AMPLIFIER ZERO SET (TSC SERIES)

The amplifier zero set should be checked periodically. Annual calibration is adequate for most applications.

PROCEDURE

1. Set the dials to zero and the range switch to 1V. Allow a 30 minute warm-up.

2. Use a microvoltmeter such as the Keithley Model 155 or equivalent, set to the 10-0-10 microvolt range and connect it across the + and - sense terminals on the left side of the unit. The terminal shorting plugs/ links MUST BE IN PLACE.

3. If the meter exceeds +/-5 microvolts, adjust the zero set, which is located under an access hole on the right side of the case at the top rear. Remove the snap-in cap, and adjust with a screwdriver until the output is within +/-5 microvolts of zero. Switch polarity from "+" to "-" and keep adjusting until the readings for each polarity are equal. Replace the cap.

5.2.2 AMPLIFIER ZERO SET (ETS-15)

The amplifier zero set zero set should be checked periodically. Annual calibration is adequate for most applications.

PROCEDURE

1. Set the dials to zero, the Material Selector to Uncompensated Output and the Operating Mode to Thermocouple Simulation Zero Ohms. Allow at least 1 hour warm-up since thermal stability is extremely important.

2 Use a microvoltmeter such as the Keithley Model 155 or equivalent, set to the 10-0-10 microvolt range and connect it across the C-15* terminals.

3 If the meter reading exceeds +/-5 microvolts, adjust the zero set, which is located under an access hole on the left side of the case at the top rear. Remove the snap-in cap and adjust with a screwdriver until the output is within +/-5 microvolts of zero. Switch polarity from "+" to "-" and keep adjusting until the readings for each polarity are equal. Replace the cap.

5.2.3 REFERENCE SOURCE CALIBRATION

The reference source calibration should be checked annually.

PROCEDURE (ETS SERIES)

1. Zero set the amplifier as described in Section 5.2.1.

2. Set the dials to zero, the polarity to "+" and the range switch to 10V.

3. Set the dials to the standard cell value. Connect the TSC, microvolt meter and standard cell in a differential voltmeter configuration, using the 100-0-100 microvolt range.

4. The meter should read within +/-25 microvolts of zero. If it does not, adjust the potentiometer through the hole covered by a snap-in cap on the right side at the lower front. Replace cap.

* C-15 Uncompensated Output Adaptor - (see Optional Accessories)

PROCEDURE (ETS-15)

{Applies to instrument S/N 146 and higher}

1. Zero set the amplifier as described in 5.2.2.

2. Set the dials to 999910 polarity to "+" and leave all other switches as set for 5.2.2.

3. Using a calibrated 100 mV source (ie: General Resistance Model DAS46-AL) accurate to better than +/-0.0015% of output, connect the ETS, the microvolt meter and the 100 mV source in a differential voltmeter configuration. Set the microvolt meter to the 10-0-10 microvolt range.

4. The meter should read within +/-5 microvolts of zero. If it does not, adjust the potentiometer through the hole covered by the snap-in-cap on the right side of the ETS at the upper rear. Replace cap.

5.3 OPTIONAL ACCESSORIES

A. UNCOMPENSATED OUTPUT ADAPTOR (C-15)

When used with the ETS-15, the C-15 provides remote sensing constant voltage operation (copper outputs). Maximum output +/-100 mV; resolution 1uV: maximum load current 30 mA. See Section 4.2B.

Not for use with TSC's, which have built-in constant voltage capability to +/-10V (copper outputs). See specification sheet: TSC, Constant Voltage Source.

B. CONSTANT CURRENT ADAPTOR (DAA-40)

The scale factor of the DAA-40 is 10 mA/V; its sensing resistor is 100 ohms. When used with the TSC Series, it provides constant current operation as described in the specification sheet under: TSC, Constant Current Source. The DAA-40 is not recommended for use with the ETS-15 due to low compliance voltage.

C. LOW NOISE ATTENUATOR (LNA-100)

In constant voltage operation at very low output levels, the inaccuracy contributed by a possible +/-5 mV offset may become the determining element of output voltage accuracy. Where output current is not a consideration, the use of the LNA-100 will reduce the offset (and the dialed output voltage) by a factor of 100. The output impedance of the LNA-100 is 10 ohms; its accuracy is +/-0.005%.

6.0 OPERATING INSTRUCTIONS TSC AS A VOLTAGE/CURRENT SOURCE

6.1 POWER

Connect the power plug to a source of 115 VAC at 50/60 cps and turn the POWER switch on. Power is indicated by the red light on the front panel.

6.2 WARMUP

The instrument is ready for use almost immediately after the power is turned on. Allow a period of 30 to 40 seconds for the amplifier to come out of saturation. The instrument will be within its accuracy specifications within 2 to 5 minutes after turn-on in a 25^{o}C environment, although 30 minutes may be required for maximum stability.

6.3 RANGE

With the instrument Range switch in the 10V position, output voltages from 0 to 10 volts may be dialed in10 microvolt steps. For voltages from 0 to 1.0 volt, greater accuracy and resolution (1uV per step) will be obtained with the RANGE SWITCH in the 1V position. These resolution figures are 0.1 uV per step and 1uV per step in the 1 and 10 volt ranges using a seven decade model.

6.4 POLARITY

Position the OUTPUT SWITCH to PLUS if the desired polarity i that indicated by the OUTPUT terminals. For the opposite polarity, throw the OUTPUT switch to MINUS.

6.5 OUTPUT VOLTAGE

Set the dial switches to read the desired output voltage. On the 10V range, the decimal point is read between the first and second digits. On the 1V range, it is read before the first digit. These decimal point positions are conveniently color coded. All dials except the first may be continuously rotated in either direction. This permits quicker switching between high and low digits. The first dial has stops at the 0 to 9 positions.

6.6 REMOTE SENSING

If the load is to be connected through an appreciable resistance such as a long cable, remove the shorting bars between the SENSE terminals and the OUTPUT terminals and connect the SENSE terminals to the load by separate wires. The dialed voltage will then appear across the load. The loop resistance of the OUTPUT leads should be limited to 20 ohms when remote sensing is employed, so that the 10 volt maximum output can be attained. The remote sensing leads may require shielding to prevent hum pick up on the output leads.

6.7 LOAD IMPEDANCE

To maintain proper operating conditions for the amplifier, the OUTPUT terminals should not be directly loaded with more than 1 MFD of capacitance. Shorting the output will not injure the DIAL-A-SOURCE, but 60 seconds may be required for it to return to normal operation after the short is removed.

6.8 CONSTANT CURRENT OPERATION

To operate the instrument as an adjustable constant current source, a model DAA-40 is required. The following instructions apply:

Remove the shorting bars between the +SENSE and +OUTPUT terminals, and plug the Adaptor into all four terminals. Connect the load to the output of the Adaptor. The load current, in milliamperes, is read directly from the dials. On the 1V range, the decimal point falls between the first and second dials. On the 10V range, the decimal point falls between the second and third dials.

NOTE: On the 10V range, do not dial more than 30 ma. Higher settings will not damage the instrument, but the dialed current will not be delivered.

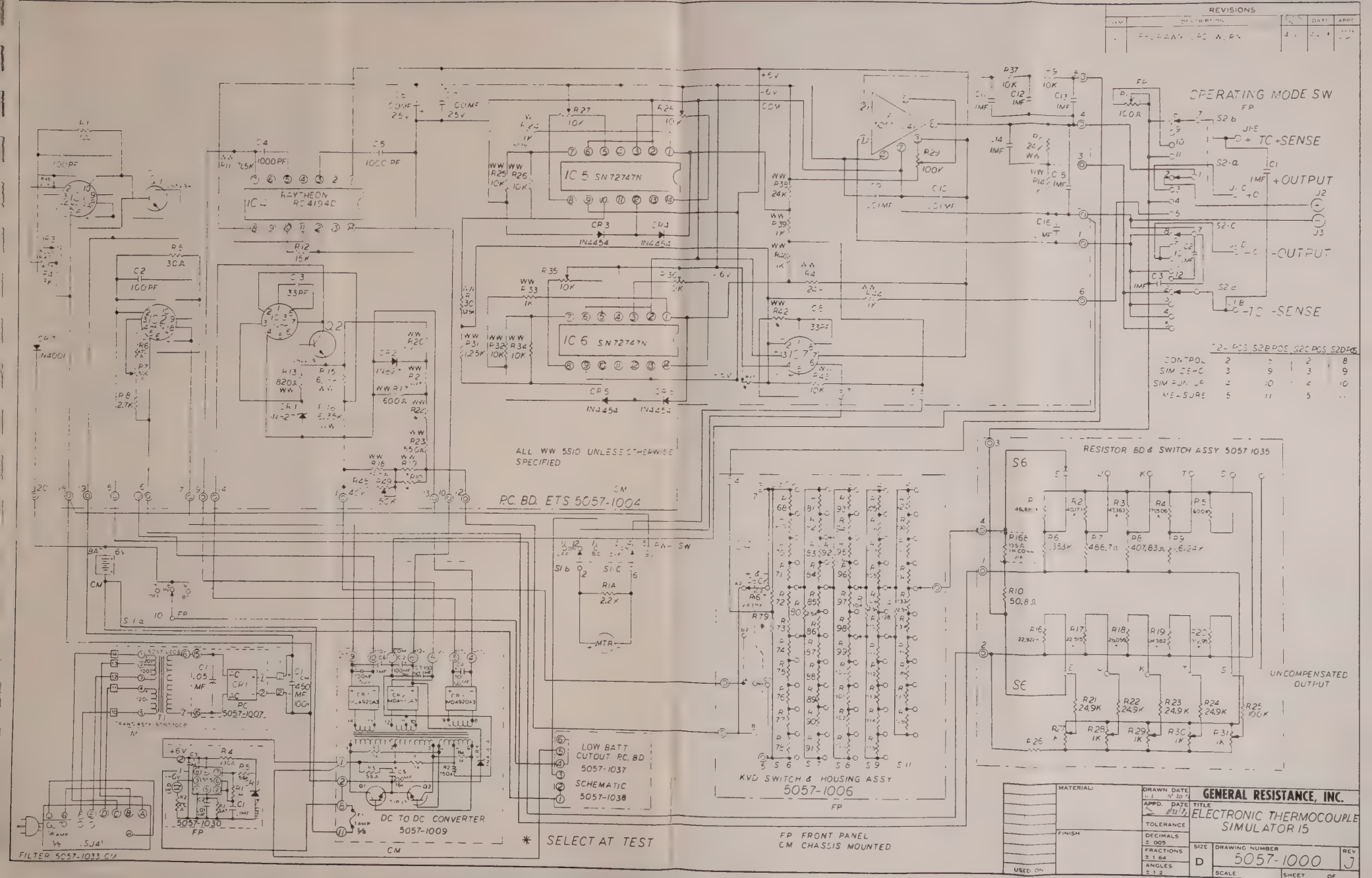
The product of load resistance and dialed current should not exceed the maximum voltage available at the output of the Dial-An-Amp Adaptor. The maximum available voltage is 10.0 volts minus the voltage indicated by the dials as normally read for voltage.

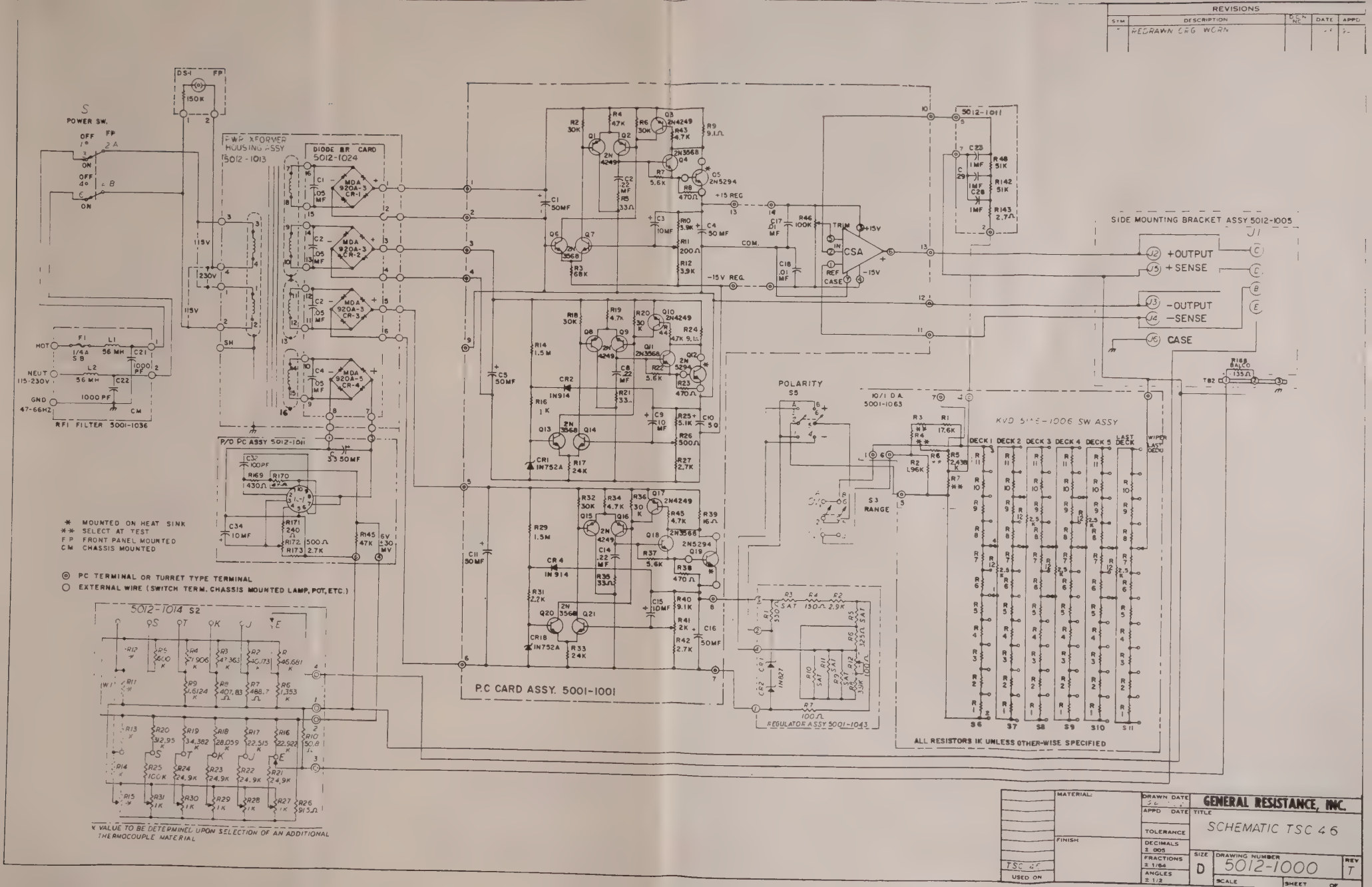
For example, on either range, when the dials are set for a constant current of 5 ma, they also indicate a voltage of 0.5V. Therefore, the maximum available voltage for this current is 10.0V - 0.5V = 9.5V. The corresponding maximum permissible load resistance is 9.5 - 5ma equal 1.9K.

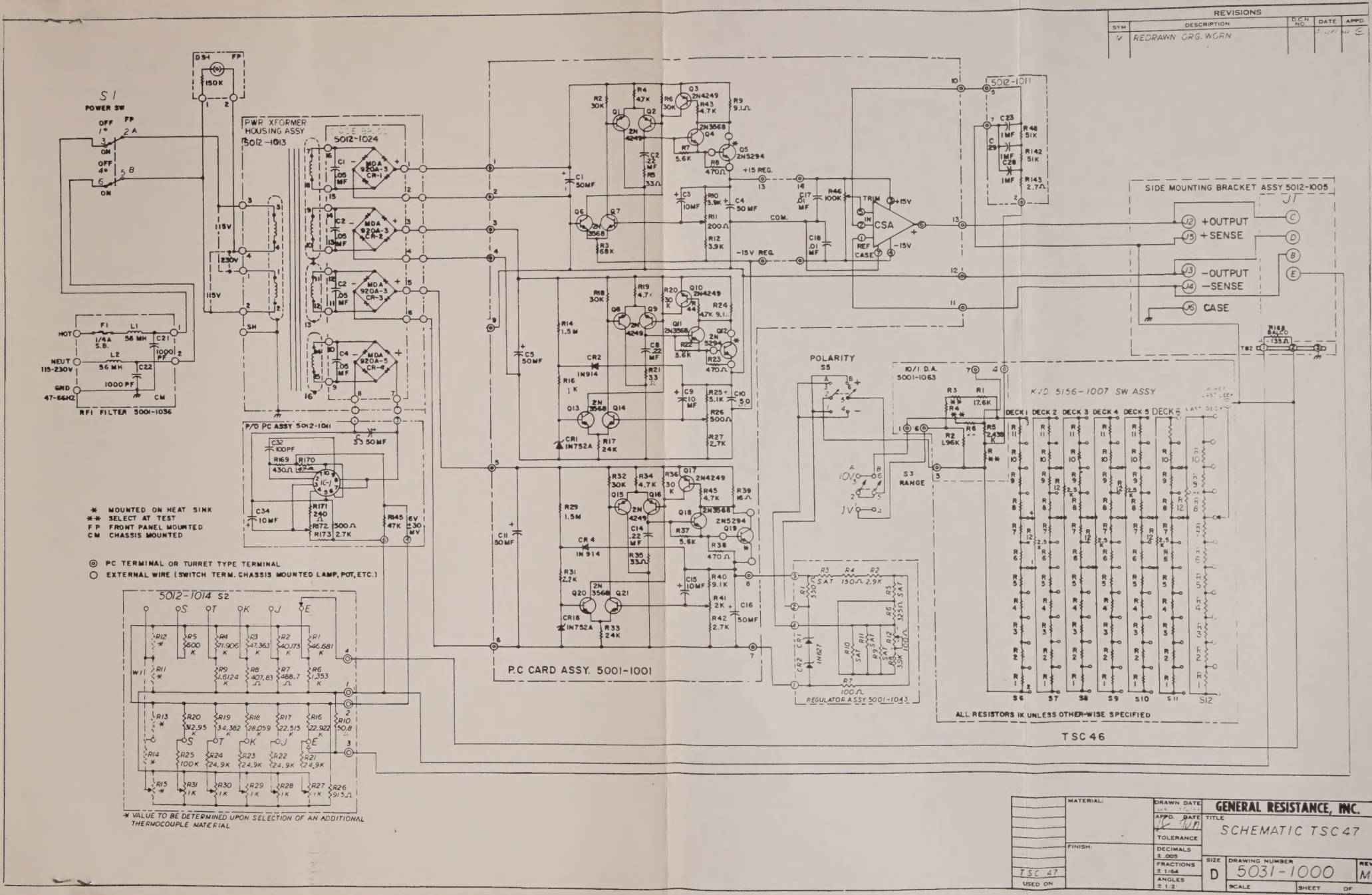
PLEASE NOTE:

TSC-46 performs as DAS-46AX

TSC-47 performs as DAS-47AL


REVISIONS
OPERATING MODE SW
FP
+ TC +SENSE
+OUTPUT
-OUTPUT
- TC -SENSE
ALL WW 5510 UNLESS OTHERWISE SPECIFIED
P.C. BD. ETS 5057-1004
CM
RESISTOR BD & SWITCH ASSY 5057 1035
UNCOMPENSATED OUTPUT
KVD SWITCH & HOUSING ASSY
5057-1006
FP
LOW BATT CUTOUT P.C. BD
5057-1037
SCHEMATIC
5057-1038
DC TO DC CONVERTER
5057-1009
CM
5057-1030
FP
5057-1007
SELECT AT TEST
FP FRONT PANEL
CM CHASSIS MOUNTED
FILTER 5057-1033 CM
GENERAL RESISTANCE, INC.
TITLE
ELECTRONIC THERMOCOUPLE SIMULATOR 15
DRAWING NUMBER
5057-1000
REV
J
SIZE
D
MATERIAL
FINISH
TOLERANCE
DECIMALS ± .005
FRACTIONS ± 1/64
ANGLES ± 1°
DRAWN
APPD.
USED ON
SCALE
SHEET
OF


REVISIONS
DESCRIPTION
REDRAWN CKG WORK
POWER SW.
PWR XFORMER HOUSING ASSY 5012-1013
DIODE BR CARD 5012-1024
MDA 920A-3 CR-1
MDA 920A-3 CR-2
MDA 920A-3 CR-3
MDA 920A-5 CR-4
RFI FILTER 5001-1036
P/O PC ASSY 5012-1011
P.C CARD ASSY. 5001-1001
5012-1011
SIDE MOUNTING BRACKET ASSY 5012-1005
+OUTPUT
+SENSE
-OUTPUT
-SENSE
CASE
CSA
POLARITY S5
S3 RANGE
10/1 D.A. 5001-1063
KVD 5112-1006 SW ASSY
DECK 1
DECK 2
DECK 3
DECK 4
DECK 5
LAST DECK
WIPER LAST DECK
REGULATOR ASSY 5001-1043
5012-1014 S2
* MOUNTED ON HEAT SINK
** SELECT AT TEST
FP FRONT PANEL MOUNTED
CM CHASSIS MOUNTED
PC TERMINAL OR TURRET TYPE TERMINAL
EXTERNAL WIRE (SWITCH TERM. CHASSIS MOUNTED LAMP, POT, ETC.)
ALL RESISTORS 1K UNLESS OTHER-WISE SPECIFIED
X VALUE TO BE DETERMINED UPON SELECTION OF AN ADDITIONAL THERMOCOUPLE MATERIAL
GENERAL RESISTANCE, INC.
SCHEMATIC TSC 46
DRAWING NUMBER 5012-1000
REV T
SIZE D
TSC 46
USED ON


REVISIONS
SYM DESCRIPTION DCN NO. DATE APPD.
A REDRAWN ORG. WORK
S1 POWER SW
PWR XFORMER HOUSING ASSY 5012-1013
SEE PAGE 5012-1024
RFI FILTER 5001-1036
P/O PC ASSY 5012-1011
5012-1011
SIDE MOUNTING BRACKET ASSY 5012-1005
+OUTPUT
+SENSE
-OUTPUT
-SENSE
CASE
POLARITY S5
S3 RANGE
10/1 D.A. 5001-1063
K/D 5156-1007 SW ASSY
DECK 1
DECK 2
DECK 3
DECK 4
DECK 5
DECK 6
LAST DECK
S6
S7
S8
S9
S10
S11
S12
P.C CARD ASSY. 5001-1001
REGULATOR ASSY 5001-1043
5012-1014 S2
* MOUNTED ON HEAT SINK
** SELECT AT TEST
FP FRONT PANEL MOUNTED
CM CHASSIS MOUNTED
PC TERMINAL OR TURRET TYPE TERMINAL
EXTERNAL WIRE (SWITCH TERM. CHASSIS MOUNTED LAMP, POT, ETC.)
* VALUE TO BE DETERMINED UPON SELECTION OF AN ADDITIONAL THERMOCOUPLE MATERIAL
ALL RESISTORS 1K UNLESS OTHER-WISE SPECIFIED
TSC 46
MATERIAL:
FINISH:
TSC 47
USED ON
DRAWN DATE
APPD. DATE
TOLERANCE
DECIMALS ± .005
FRACTIONS ± 1/64
ANGLES ± 1/2°
GENERAL RESISTANCE, INC.
TITLE
SCHEMATIC TSC47
SIZE D
DRAWING NUMBER 5031-1000
REV M
SCALE
SHEET OF

Document Title: Product Manuals	Document Number: ESC-1871-92-01
Revision Number: A X B_ C_ D_ E_	Page: N/A
Prepared By: Rick Schultz	Approved By: [signature]
Issued By: Jim Steinau	Issue Date: 10/19/93

CHANGE NOTICE SUMMARY

Revision	Reason for Change	Date of Change

HONEYWELL INC.

Industrial Automation and Control Division
Honeywell Inc.
621 Lockhaven Drive
Houston, Texas 77073

From the Desk of :
Rick Gonzales
713 233-2365
713 821-3705 Fax

To : Bruce
GTE

Fax # 219-424-1031

Number of Pages to Follow _____

Comments : Info. on Cal. of TSC-46

~~MANUFACTURE : TSC 46~~

~~model :~~

MAN : GENERAL RESISTANCE
model : TSC 46
Nom : THERmocouple System CALIBRator

MP MASTER
MA32616